IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

Koichi Fujii et al.

Serial No.: 10,573,709 Group Art Unit: 1794

Filed: March 27, 2006 Examiner: Mulvaney, Elizabeth Evans

For: OPTICAL DISK

DECLARATION UNDER 37 CFR §1.132

I, Fujii Koich, a citizen and resident of Japan, hereby declare as follows:

I am a co-inventor on the above-identified U.S. patent application and I make this declaration to support the patentability of the claims of the subject application. I work as a professional in the field of optical disks and among my professional specialties work in new developments of optical disks. I am employed by DIC Corporation, which is the owner by assignment of the application. I have read and am familiar with the Office Action concerning this Application issued by the U.S. Patent and Trademark Office and mailed on June 16, 2009.

Experiments

In order to show what causes blackening of a reflective layer and to confirm the effect of the present invention, optical disks comprising a semi-reflective layer made of an alloy containing silver were prepared and exposed to room light, and observation with TEM and element mapping with electron probe micro-analyzer were conducted. Preparation method and evaluation methods are described below.

Manufacturing of DVD-9 Disks A and B

At first, ultraviolet curable compositions A and B were prepared as described below.

The difference between the compositions A and B is that the compositions A included gallic acid but the composition B did not include galic acid.

Preparation of the composition A

An ultraviolet curable composition A was prepared similar to Example 1 of the present specification, except that the amount of gallic acid was increased from 0.05 parts to 0.3 parts. The color of the obtained ultraviolet curable composition was a pale yellow and transparent. Antioxidant (IRGAGONOX 1520L) used in Example 1 is a compound represented by the general formula 8 of the present specification, and is not a compound disclosed in Claims 26 and 27 of the present application. The antioxidant is not a compound represented by the formula (6), gallic acid, 2-hydroxyhydroquinone or resorcinol.

Preparation of the composition B

An ultraviolet curable composition B was prepared similar to Comparative Example 1 of the present specification. As described above, the difference between the compositions A and B is that gallic acid is not included in the composition B. The color of the obtained ultraviolet curable composition was a pale yellow and transparent.

Manufacturing of disks

Using the compositions A and B, a DVD-9 optical disk A and a DVD-9 optical disk B were prepared as follows. Polycarbonate substrates 1 for optical disk, wherein recording information pits were formed and an aluminium thin film of 50 nm thickness had been laminated thereon, were prepared. Polycarbonate substrates 2, wherein a 15 nm thick semi-reflective layer made of an alloy containing silver as a main component was laminated thereon, were also prepared. The composition A was coated on the aluminium thin film of one of the substrates 1 with a dispenser, and then, one of the

substrates 2 was laminated on the applied composition A so that thin film (semi-reflective layer) of the substrate 2 was directly provided on the composition A to form a laminate. The obtained laminate was rotated with a spin coater so that a resulting cured coating had a thickness of about 50 to 60 μm, and then, 10 shot ultraviolet light was exposed with a xenon flash lamp manufactured by Ushio Inc from the side of the substrate having a silver alloy semi-reflective layer at the programmed voltage of 1800 V in air to generate a DVD-9 disk A wherein a cured layer of the composition A was included as an adhesive layer. Similarly, the composition B was used to combine substrates 1 and 2 and to generate a DVD-9 disk B.

Exposure to light of a fluorescent lamp

The DVD-9 disks A and B were exposed to light of a fluorescent lamp as follows. Three 20 W fluorescent lamps (manufactured by Mitsubishi Electric Corporation, NEOLUMISUPER FLR20SW/M (20 watt)) were arranged in parallel on the same plane so as to adjust the center-distance of the fluorescent lamps to 9 cm. The optical disks A and B, which were partially covered to form an unexposed portion, were disposed at a position, which was 10 cm away from the center fluorescent lamp, so that the read side (the side of the silver alloy semi-reflective layer) of the optical disk and fluorescent lamp face each other, and an exposure test with a fluorescent lamp was continued for 72 hours.

Preparation of samples for analysis

The exposed DVD-9 disk A was separated into two parts at the interface of the silver alloy semi-reflective layer and the cured film of the compositions A (adhesive layer) to obtain a sample, wherein the polycarbonate substrate 1, the aluminium thin film and the cured film of the compositions A are laminated in this order but does not include the silver alloy semi-reflective layer. Furthermore, the surface of the cured film of the compositions A (adhesive layer) was embedded with a resin (Visible light embedding

resin Luxtrak D-800, manufactured by TOAGOSEI CO., Ltd.) Then, the embedded sample was cut using a microtome so that a cross section of the sample was shown, and an analysis sample of the DVD-9 disk A was obtained. Similarly, an analysis sample of the DVD-9 disk B was prepared.

Observation of the analysis samples

Observation with TEM and element mapping were conducted using the following apparatuses. Analysis data and charts obtained were attached as data Nos. 1 to 8, and results were shown below.

(i) Transmission electron microscope (TEM)
H-7100 type electron microscope manufactured by Hitachi, Ltd., observation conditions: Accelerating voltage 100 KV, observation magnification × 40000
(ii) Electron Probe Microanalyser
ERA-8000FE manufactured by ELIONIX Co., Ltd., observation conditions: accelerating voltage 20 KV, observation magnification × 10000
Element mapping device: DX-4 manufactured by EDAX Co., Ltd.

Regarding the data of Nos. 6 to 8, which show the results of element mapping, the upper left hand figure in each data shows an enlarged photography (magnification: × 10000) at the position where element mapping was conducted. The magnification was smaller than that of TEM, and therefore, silver particles are not observed even when particles were observed by TEM. The upper right hand figure shows an element mapping chart of oxygen, which was conducted at the same part of the aforementioned upper left hand figure. The lower left hand figure shows an element mapping chart of silver, which was also conducted at the same part of the upper left hand figure. The three figures show the same position of samples, and therefore, the interface of the adhesive layer and the embedding resin exist at the same position in the figures. Furthermore, "O K" shown in the upper right hand figure means a characteristic X-ray at the time of

embedding a K-shell of an oxygen atom, and "AgL" shown in the lower left figure means a characteristic X-ray at the time of embedding a L-shell of a silver atom. Regarding the results of the element mapping, the colored dots do not means silver. Furthermore, "uniform" shown in the following Table 1 means that the background of the element mapping chart can be uniformly colored at the adhesive layer due to the adjustment of detection sensibility. That is, "uniform" means that distribution strength of the sample is uniform. When silver atoms enter in the sample, ununiform distribution strength of dots is shown in an adhesive layer. Although small difference between the embedding resin portion and the adhesive layer portion may be confirmed in the electron mapping charts, the difference is resulted from the compositional difference between the embedding resin portion and the adhesive layer portion.

Evaluation results

Table 1

	Disk A		Disk B	
	Gallic acid was used.		Gallic acid was not used.	
	Unexposed position	Exposed position	Unexposed position	Exposed position
TEM (Observation of the adhesive layer)	Uniform (No. 1)	Uniform (No. 2)	Uniform (No. 3)	Particles were observed. (Nos. 4 and 5) (magnification of No. 5: × 200000)
Element mapping (Distribution strength)	Silver: Uniform Oxygen: Uniform (No. 6)	Silver: Uniform Oxygen: Uniform (No. 7)	(No data)	Silver: Strong characteristic X-ray was observed at the area where existence of particles was observed by TEM. Oxygen: Uniform (No. 8)

Regarding TEM

As shown in both Data Nos. 1 and 2, blackening was not observed in the sample of the DVD-9 disk A, even after exposure was conducted. No silver particles are observed in the data.

On the other hand, as shown in Data Nos. 3 to 5, when gallic acid was not used in the adhesive layer, blackening was caused due to exposure to light in the sample of the DVD-9 disk B. After exposure to light, silver particles, which were shown as black parts in TEM, were immigrated in the adhesive layer of the DVD-9 disk B. Existence of a lot of silver particles were observed in the vicinity of the interface with the silver alloy semi-reflective layer which had been removed.

Regarding Element Mapping

As shown in the charts of Data No. 6, at the unexposed portion of the adhesive layer of the DVD-9 Disk A, both distribution strengths of Ag and O of electron mapping are uniform. Furthermore, as shown in the charts of Data No. 7, at the exposed portion of the adhesive layer of the DVD-9 Disk A, both distribution strengths of Ag and O of electron mapping are uniform. The results show that silver particles have not been entered in the adhesive layer of the DVD-9 Disk A, similar to the result of TEM (Data No. 2).

On the other hand, as shown in the lower left chart of Data No. 8, it was confirmed that distribution strength of electron mapping of Ag was enlarged in the exposed portion of the adhesive layer of the Disk Bin. The portion, where distribution strength is enlarged, is in the vicinity of the interface with the silver alloy semi-reflective layer which had been removed. Colored dots (red) are concentrated at the area where a lot of silver particles were observed by TEM.

However, also shown in the upper right chart of Data No. 8, distribution strength of O was uniform. It shows that the black particles in the exposed portion of the adhesive layer of the Disk B are not silver oxide particles but silver particles.

Conclusion

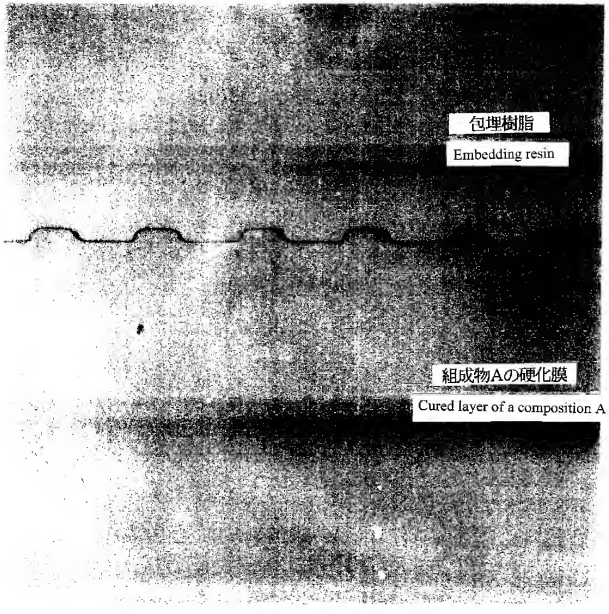
In this way, although it has been generally understood by a person with ordinary skill in the art that blackening is caused by oxidation of silver when silver exist, the data shows that migration of silver from a reflective layer made of silver or an alloy containing silver to an adhesive layer, which is adjacent to the reflective layer, actually causes blackening. Furthermore, the above data also show that the presence of a specific compound disclosed in the claims of the present invention can prevent migration of silver from a silver alloy semi-reflective layer into an adhesive layer. Such unexpected results are not disclosed in references US 6925051, US 2001/0017819 or US 6071667.

6. I fully understand the content of this declaration.

7. I, KOICHI FUJII, the undersigned declarant, declare further that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further, that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001, of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

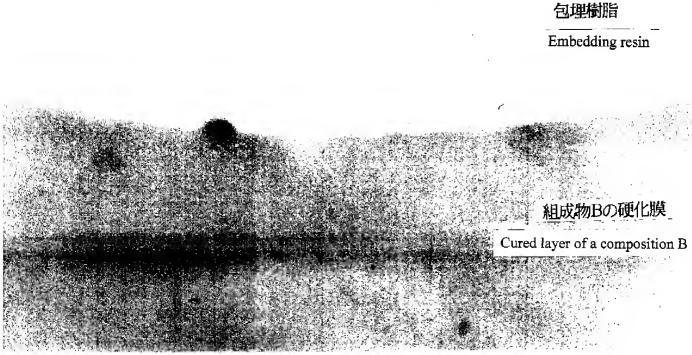
KOICHI FUJII Date: 2009. 11. 4

No.1 Disk A 未露光部
(unexposed portion)



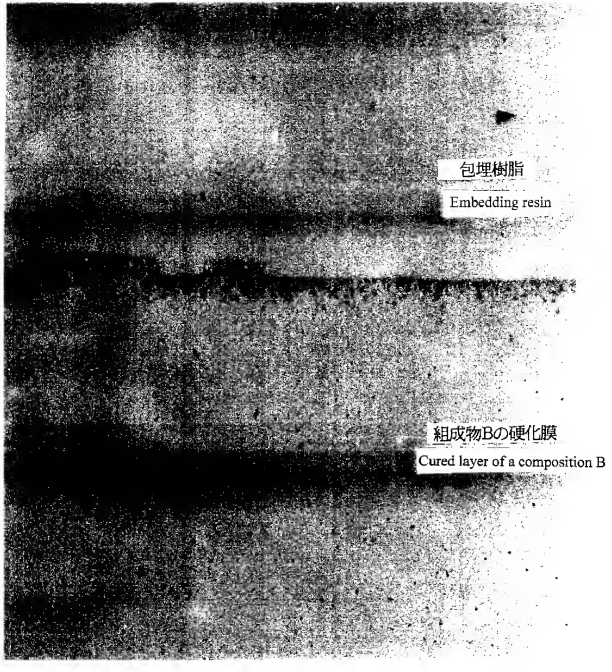
No.2 Disk A 露光部

(exposed portion)



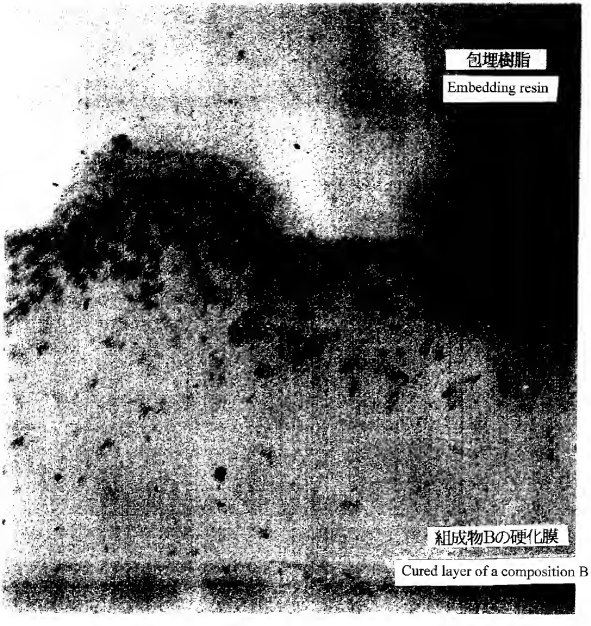
No.3 Disk B 未露光部

(unexposed portion)



No.4 Disk B 露光部

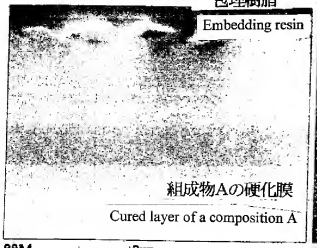
(exposed portion)

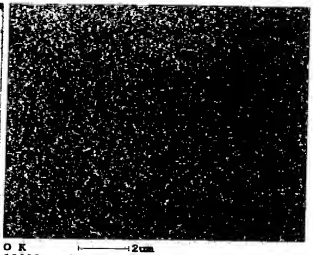


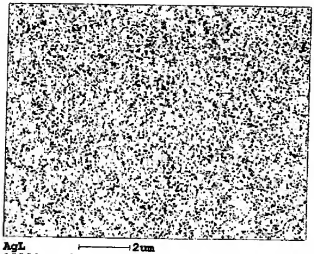
0.2 μ m

No.5 Disk B 露光部

(exposed portion)

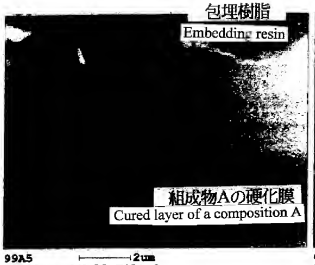


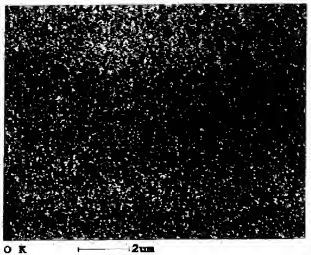


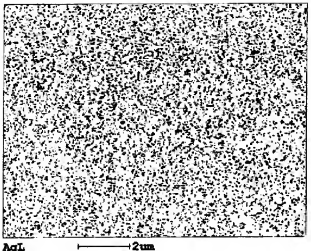


No.6 Disk A 未露光部

(unexposed portion)

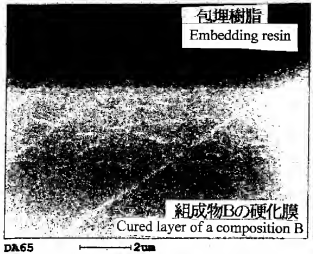


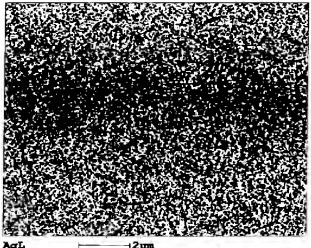




No.7 Disk A 露光部

(exposed portion)





No.8 Disk B 露光部

(exposed portion)